SBRT for Prostate Cancer

Leonid B. Reshko, MD (PGY-4)
Faculty Advisor: Scott R. Silva, MD, PhD
Department of Radiation Oncology
University of Louisville
Objectives

To review key aspects of prostate cancer SBRT for radiation oncology trainees through a case vignette

1. Recognize the indications for prostate SBRT
2. Learn about the differences between ultrahypofractionation and more protracted fractionation schemes
3. Review the major clinical trials, retrospective studies and practice guidelines
4. Understand practical treatment planning considerations
Case

- 50-year-old male presented to his primary care physician with dysuria and was referred to Urology.
- He was found to have an elevated PSA:
  - ECOG: 0; KPS: 100
  - IPSS 8; SHIM: 21
<table>
<thead>
<tr>
<th>PSA</th>
<th>2 years ago</th>
<th>1 year ago</th>
<th>Most recent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.02</td>
<td>3.46</td>
<td>4.02</td>
</tr>
</tbody>
</table>
- PMHx: h/o DVT, BPH, microhematuria with a negative CT abdomen/pelvis, dysuria, intermittent erectile dysfunction, arthritis, GERD
- SurgHx: Hernia repair, cholecystectomy
- SocHx: No smoking, alcohol or illicit drug use
- Meds: Eliquis, Flomax
- FMHx: Father, paternal uncles, maternal grandfather and maternal uncles had prostate cancer
- Physical Exam: Appears to be of his stated age in no distress. Enlarged prostate with no palpable nodules or evidence of extraprostatic extension or SV involvement. No bone tenderness.
Case

- Systematic TRUS biopsy: Gleason 3+3=6 in 3 out of 12 cores in the right mid lateral and right lateral apex. Up to 60% of a core was involved. Grade group 1.
- Prostate volume: 45 cc.
- AJCC 8th edition T1cN0M0, Stage I
Brief Overview of Localized Prostate Cancer Treatment Options

• Watchful waiting
• Active surveillance
• Radical prostatectomy
• Definitive radiotherapy +/- ADT
  – Conventionally-fractionated
  – Hypofractionated
  – Ultrahypofractionated
  – Brachytherapy
  – EBRT + brachytherapy
Rationale for using SBRT in Prostate Cancer

- Low alpha/beta ratio of 1.5-1.8 (CHHiP trial and Perez and Brady)
- If the alpha/beta for dose-limiting normal tissue is less than that of the tumor, larger fraction sizes preferentially kill the tumor compared to normal tissue
- Increased patient convenience
- Increased access for underserved patient populations (long commute etc)
- More cost-effective than other EBRT fractionation schedules

Indications for SBRT in Prostate Cancer

• NCCN 2020: very low, low, favorable intermediate, unfavorable intermediate, high, very high-risk prostate cancer and low volume M1 disease
• ASTRO, ASCO and AUA 2018: low and intermediate-risk disease
• 2020 COVID19 pandemic recommendation: 5- to 7-fraction SBRT is preferred for localized prostate cancer that requires treatment

HYPO-RT-PC

- Phase 3 non-inferiority randomized trial in 12 centers in Sweden and Denmark
- Men up to 75 years of age with intermediate-to-high-risk prostate cancer
- 1200 patients, 89% were intermediate risk, median follow-up: 5 years
- SBRT (42.7 Gy in 7 fractions) vs conventional fractionation (78 Gy in 39 fractions) with no ADT

Widmark et al Lancet 2019
• No difference in oncologic outcomes (SBRT was non-inferior to 78 Gy in 39 fractions)
  – 5-year failure-free survival was 84% in both groups at 5 years (HR 1.002, 95% CI 0.758-1.325; p = 0.99)
• No difference in physician-reported GI, GU or sexual toxicity except for increased urinary toxicity at one year for SBRT (6% vs 2%)
• Patient-reported outcomes with Prostate Cancer Symptom Scale (PCSS): greater acute urinary and bowel symptoms with SBRT but no difference in chronic symptoms except for urinary toxicity at one year (also worse with SBRT)

Widmark et al Lancet 2019
Failure-free survival

Non-adjusted HR 1.002 (95% CI 0.760–1.320), log-rank p=0.99
Adjusted HR 1.002 (95% CI 0.758–1.325)

Number at risk (number censored)

<table>
<thead>
<tr>
<th></th>
<th>Conventional fractionation</th>
<th>Ultra-hypofractionation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time from randomisation (years)</td>
<td>1</td>
<td>591</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>(0)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>580</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>(0)</td>
</tr>
</tbody>
</table>
GU toxicity

Patient-reported problems

Symptom severity

Baseline | Treatment end | 3 months | 6 months | 1 year | 2 years | 4 years | 6 years | 8 years | 10 years
---|---|---|---|---|---|---|---|---|---
Conventional fractionation
Number assessed | 468 | 464 | 336 | 347 | 427 | 404 | 272 | 156 | 59 | 21
p value | 0.78 | 0.0066 | 0.018 | 0.16 | 0.0036 | 0.18 | 0.49 | 0.19 | 0.98 | 0.57
Ultra-hypofractionation
Number assessed | 478 | 439 | 330 | 358 | 425 | 425 | 275 | 143 | 72 | 24
p value | | | | | | | | | |

Treatment
- Conventional fractionation
- Ultra-hypofractionation
GI toxicity

Patient-reported problems

Symptom severity

Treatment
- Conventional fractionation
- Ultra-hypofractionation

Number assessed
- Conventional fractionation
- Ultra-hypofractionation
- p value

<table>
<thead>
<tr>
<th>Baseline</th>
<th>Treatment end</th>
<th>3 months</th>
<th>6 months</th>
<th>1 year</th>
<th>2 years</th>
<th>4 years</th>
<th>6 years</th>
<th>8 years</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>469</td>
<td>463</td>
<td>329</td>
<td>346</td>
<td>423</td>
<td>404</td>
<td>273</td>
<td>152</td>
<td>61</td>
<td>22</td>
</tr>
<tr>
<td>485</td>
<td>440</td>
<td>335</td>
<td>359</td>
<td>426</td>
<td>427</td>
<td>277</td>
<td>145</td>
<td>73</td>
<td>24</td>
</tr>
<tr>
<td>0.93</td>
<td>&lt;0.0001</td>
<td>0.26</td>
<td>0.42</td>
<td>0.059</td>
<td>0.32</td>
<td>0.20</td>
<td>0.75</td>
<td>0.035</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Association of Residents in Radiation Oncology
Sexual dysfunction

Symptom severity

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Baseline</th>
<th>Treatment end</th>
<th>3 months</th>
<th>6 months</th>
<th>1 year</th>
<th>2 years</th>
<th>4 years</th>
<th>6 years</th>
<th>8 years</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional fractionation</td>
<td>453</td>
<td>443</td>
<td>318</td>
<td>331</td>
<td>412</td>
<td>396</td>
<td>266</td>
<td>153</td>
<td>61</td>
<td>21</td>
</tr>
<tr>
<td>Ultra-hypofractionation</td>
<td>470</td>
<td>414</td>
<td>319</td>
<td>346</td>
<td>410</td>
<td>405</td>
<td>260</td>
<td>135</td>
<td>66</td>
<td>22</td>
</tr>
<tr>
<td>p value</td>
<td>0.31</td>
<td>0.066</td>
<td>0.28</td>
<td>0.62</td>
<td>0.74</td>
<td>0.18</td>
<td>0.57</td>
<td>0.41</td>
<td>0.47</td>
<td>0.90</td>
</tr>
</tbody>
</table>
PACE-B

- Phase 3 non-inferiority randomized trial in 37 centers in UK, Ireland and Canada
- Low to favorable intermediate risk prostate cancer
- 874 patients, 85% Gleason Score 3+4=7, median follow-up: 12 weeks
- SBRT (36.25 Gy in 5 fractions with a concomitant boost to 40 Gy) vs conventionally fractionated or moderately hypofractionated EBRT (78 Gy in 39 fractions or 62 Gy in 20 fractions) with no ADT
- Unlike HYPO-RT-PC, there was no difference in toxicity with SBRT including patient-reported outcomes
- GI and GU toxicity timing differed: occurred earlier during treatment and resolved faster with SBRT
- Oncologic outcomes are not yet available

Brand et al Lancet Oncol 2019
GI toxicity

Number of patients

<table>
<thead>
<tr>
<th>CFMHRT</th>
<th>429</th>
<th></th>
<th></th>
<th>270</th>
<th>291</th>
<th>389</th>
<th>397</th>
<th>412</th>
<th>122</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBRT</td>
<td>413</td>
<td>398</td>
<td>396</td>
<td>382</td>
<td>385</td>
<td>387</td>
<td>399</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
GU toxicity
Retrospective Data

- Jackson et al meta-analysis
  - 38 prospective trials with 6116 patients including low, intermediate and high-risk patients
  - 7-year biochemical relapse free survival (bRFS) was 93.7%, late >=3 GU and GI toxicity rates were 2% and 1.1%
King et al
- pooled analysis of prospective trials from 8 institutions with a total of 1100 patients
- 5-year bRFS was 93%
- No difference in outcome with ADT use
- PSA bounce > 0.2 ng/ml was noted in 16% of patients
• Kishan et al
  – pooled analysis of prospective trials from 10 institutions with a total of 2142 patients
  – 7-year bRFS was 95.5% for low-risk, 91.4% for favorable intermediate-risk and 85.1% for unfavorable intermediate-risk disease
<table>
<thead>
<tr>
<th>Source</th>
<th>Years Treated</th>
<th>No. of Patients</th>
<th>Follow-up, Median (Range, y)</th>
<th>Dose/Fraction (% of Patients Who Received Dose/Fraction)</th>
<th>Prescription Specification, %</th>
<th>Risk Group, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masen et al, 2007</td>
<td>2000-2004</td>
<td>40</td>
<td>5.9 (0.7-15.0)</td>
<td>6.7 Gy ×5</td>
<td>90 Of prescribed dose to cover 100 of GTV</td>
<td>100 Low</td>
</tr>
<tr>
<td>King et al, 2012</td>
<td>2003-2009</td>
<td>67</td>
<td>9.5 (3.3-13.3)</td>
<td>7.25 Gy ×5</td>
<td>100 Of prescribed dose to cover 95 of PTV</td>
<td>73 Low, 15 Fav Int, 2 Unfav Int</td>
</tr>
<tr>
<td>Katz and Kang, 2014</td>
<td>2006-2010</td>
<td>477</td>
<td>7.9 (0.5-9.9)</td>
<td>7 Gy ×5 (32) and 7.25 Gy ×5 (68)</td>
<td>100 Of prescribed dose to cover 95 of PTV</td>
<td>68 Low, 22 Fav Int, 9.8 Unfav Int</td>
</tr>
<tr>
<td>Mantz, 2014</td>
<td>2007-2012</td>
<td>415</td>
<td>7.7 (5.0-10.4)</td>
<td>8 Gy ×5</td>
<td>100 Of prescribed dose to cover 98 of PTV</td>
<td>68.2 Low, 27 Fav Int, 5 Unfav Int</td>
</tr>
<tr>
<td>Meier et al, 2018</td>
<td>2008-2011</td>
<td>141</td>
<td>5.0 (0.1-8.2)</td>
<td>7.25 Gy ×5</td>
<td>100 Of prescribed dose to cover 95 of PTV</td>
<td>35 Low, 33 Fav Int, 31 Unfav Int</td>
</tr>
<tr>
<td>Fuller et al, 2018</td>
<td>2007-2012</td>
<td>206</td>
<td>5.0 (0.1-9.6)</td>
<td>9.5 Gy ×4</td>
<td>100 Of prescribed dose to cover 95 of PTV</td>
<td>43 Low, 35 Fav Int, 21 Unfav Int</td>
</tr>
<tr>
<td>Alayed et al, 2018</td>
<td>2006-2008</td>
<td>84</td>
<td>9.6 (1.0-10.8)</td>
<td>7 Gy ×5</td>
<td>95 Of prescribed dose to cover 99 of PTV</td>
<td>100 Low</td>
</tr>
<tr>
<td>Alayed et al, 2018</td>
<td>2010</td>
<td>30</td>
<td>6.8 (5.7-7.2)</td>
<td>8 Gy ×5</td>
<td>95 Of prescribed dose to cover 99 of PTV</td>
<td>60 Low, 30 Fav Int, 10 Unfav Int</td>
</tr>
<tr>
<td>McBride et al, 2012</td>
<td>2006-2011</td>
<td>135</td>
<td>6.3 (0.1-10.3)</td>
<td>7.25 Gy ×5</td>
<td>100 Of prescribed dose to cover 95 of PTV</td>
<td>35 Low, 31 Fav Int, 34 Unfav Int</td>
</tr>
<tr>
<td>UCLA</td>
<td>2010-2012</td>
<td>95</td>
<td>6.0 (0.3-8.1)</td>
<td>8 Gy ×5</td>
<td>100 Of prescribed dose to cover 95 of PTV</td>
<td>91 Low, 5 Fav Int, 4 Unfav Int</td>
</tr>
<tr>
<td>Fuller et al, 2014</td>
<td>2006-2012</td>
<td>51</td>
<td>6.0 (1.7-10.1)</td>
<td>9.5 Gy ×4</td>
<td>100 Of prescribed dose to cover 95 of PTV</td>
<td>1 Low, 71 Fav Int, 28 Unfav Int</td>
</tr>
<tr>
<td>Kataria et al, 2017</td>
<td>2007-2012</td>
<td>402</td>
<td>4.3 (1.8-9.1)</td>
<td>7 Gy ×5 (33) and 7.25 Gy ×5 (67)</td>
<td>100 Of prescribed dose to cover 95 of PTV</td>
<td>36 Low, 48 Fav Int, 16 Unfav Int</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2000-2012</td>
<td>2142</td>
<td>6.9 (0.1-15.0)</td>
<td>NA</td>
<td>NA</td>
<td>65 Low, 25 Fav Int, 9.9 Unfav Int</td>
</tr>
</tbody>
</table>
Ongoing Trials

• Stereotactic Body Radiation Therapy or Intensity-Modulated Radiation Therapy in Treating Patients With Stage IIA-B Prostate Cancer NRG GU005
  – IMRT vs SBRT

• Radiation Hypofractionation Via Extended Versus Accelerated Therapy (HEAT) For Prostate Cancer (HEAT)
  – 70.2 Gy in 26 fractions vs 36.25 Gy in 5 fractions
  – Low and intermediate risk disease included
Back to the Case

• Treatment options for low-risk prostate adenocarcinoma including active surveillance (preferred), radical prostatectomy and radiotherapy were discussed.

• Germline testing was considered due to positive family history, but the patient declined it.

• Patient decided on definitive radiotherapy due to concern over cancer progression given his age and family history.

• SBRT was chosen due to convenience.
Technical Considerations

• Prostate size: prostate volume has to be < 60 cc to be included on GU005
• IPSS: has to be < 15 on GU005
• Comorbidities and anticoagulation: consider prior to fiducial marker/SpaceOAR placement
• Anesthesia considerations
• Multi-parametric MRI prostate (mpMRI) and DRE: rule out locally-advanced disease and extraprostatic extension is a counterindication to SpaceOAR placement
• Risk of pelvic lymph node involvement: estimate to determine if lymph node irradiation may be indicated
Treatment Techniques

• Isocentric (Linac gantry based) vs. non-isocentric (Cyberknife)
• Coplanar vs. non-coplanar beams
• Static gantry angle IMRT vs. Volumetric arc modulated treatment (VMAT)
• Image guidance: kV imaging using fiducial markers or cone beam CT (CBCT)
Six gold prostate fiducial markers and a SpaceOAR were placed under ultrasound guidance
- At least 3 fiducial markers are needed for tracking – four or more can be placed in case there is displacement or placement outside of prostate
- The markers have to be in different planes to allow for translational/rotational adjustments

Patient underwent an mpMRI prostate on the same day as a CT simulation one week after the fiducial/SpaceOAR placement

Hamstra et al Phase III randomized trial IJROBP 2017
- 222 patients randomized 2:1 to the SpaceOAR vs control and received 79.2 Gy in 44 fractions
- 3-year grade >= 1 (9.2% vs 2.0%) and grade >= 2 (5.7% vs 0%) rectal toxicity favored the hydrogel spacer
- QOL was superior in the SpaceOAR group
Fiducial Marker Placement

Fiducial marker tracking on Cyberknife (purple crosses over the white fiducial markers)  

Lei et al Frontiers in Oncology 2011
Fiducial Markers: CT Simulation
SpaceOAR

Treatment Planning

- Patient was CT-simulated supine with arms over chest holding a ring in a vac loc bag with a comfortably full bladder and non-distended rectum
- CTV = prostate on T2-MRI fused with CT sim scan
- PTV = CTV + 5 mm in all directions except for 3 mm posteriorly
- Organs at risk were delineated and used as avoidance structures
- Cyberknife 6X photons were utilized
- kV imaging was used to ensure that the fiducial markers were in the correct position for treatment
- Treatments were administered every other day
- ASCO/ASTRO/AUA does not recommend consecutive daily treatments due to potential increased risk of late urinary and rectal toxicity
- He was treated to 3625 cGy in 5 fractions SBRT on CyberKnife
- A concomitant boost to 4000 cGy is done at some centers based on the PACE-B trial, but we do not do this
Tumor and OAR Delineation

• Prostate T2-weighed MRI mandatory for treatment planning due to superior soft tissue visualization
• Use both the MRI and CT
red: prostate; green: penile bulb, brown: rectum, yellow: bladder, cyan: small bowel and PTV expansion
red: prostate; green: penile bulb, brown: rectum, yellow: bladder, cyan: small bowel and PTV expansion
red: prostate; green: penile bulb, brown: rectum, yellow: bladder, cyan: small bowel and PTV expansion
red: prostate; green: penile bulb, brown: rectum, yellow: bladder, cyan: small bowel and PTV expansion
purple: 3988 cGy (110%); red: 3625 cGy (100%); orange: 3263 cGy (90%); yellow: 2900 cGy (80%); green: 2538 cGy (70%); cyan: 2175 cGy (60%); blue 1813 cGy (50%)
Dose Constraints from GU005

- We followed the NRG GU005 dose constraints:

<table>
<thead>
<tr>
<th>Name of Structure</th>
<th>Dosimetric parameter*</th>
<th>Per Protocol</th>
<th>Variation Acceptable</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTV_3625</td>
<td>D0.03cc[Gy]</td>
<td>&lt;= 38.78</td>
<td>&lt;=43.5</td>
<td>Arm 2</td>
</tr>
<tr>
<td></td>
<td>D99% [Gy]</td>
<td>&gt;=34.4</td>
<td>&gt;=33.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D98%[Gy]</td>
<td>&gt;=36.25</td>
<td>&gt;=34.4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Structure</th>
<th>Dosimetric Parameter</th>
<th>Acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penile Bulb</td>
<td>D0.03cc[%]</td>
<td>&lt;= 100</td>
</tr>
<tr>
<td></td>
<td>D3cc[%]</td>
<td>&lt;= 55 (19.9Gy)</td>
</tr>
<tr>
<td>Femurs</td>
<td>D10cc[%]</td>
<td>&lt;= 43 (15.6Gy)</td>
</tr>
<tr>
<td></td>
<td>D1cc[%]</td>
<td>&lt;= 55 (19.9Gy)</td>
</tr>
<tr>
<td>E-PTV-OAR***</td>
<td>D10cc[%]</td>
<td>&lt;= 30 (10.9Gy)</td>
</tr>
<tr>
<td></td>
<td>D1cc[%]</td>
<td>&lt;= 43 (15.6Gy)</td>
</tr>
</tbody>
</table>
# Dose Constraints from GU005

<table>
<thead>
<tr>
<th>Name of</th>
<th>Dosimetric parameter*</th>
<th>Per Protocol</th>
<th>Variation Acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectum</td>
<td>D0.03cc[Gy]</td>
<td>&lt;=38.06</td>
<td>&lt; 40</td>
</tr>
<tr>
<td></td>
<td>D3cc[Gy]</td>
<td>&lt;=34.4</td>
<td>&lt; 36</td>
</tr>
<tr>
<td></td>
<td>D10%[Gy]</td>
<td>&lt;=32.63</td>
<td>&lt; 34</td>
</tr>
<tr>
<td></td>
<td>D20%[Gy]</td>
<td>&lt;=29</td>
<td>&lt; 30</td>
</tr>
<tr>
<td></td>
<td>D50%[Gy]</td>
<td>&lt;=18.13</td>
<td>&lt; 19</td>
</tr>
<tr>
<td>Bladder</td>
<td>D0.03cc[Gy]</td>
<td>&lt;=38.06</td>
<td>&lt; 40</td>
</tr>
<tr>
<td></td>
<td>D50% [Gy]</td>
<td>&lt;=18.12</td>
<td>&lt; 20</td>
</tr>
<tr>
<td>Spec_Bowel</td>
<td>D0.03cc[Gy]</td>
<td>&lt;=30</td>
<td>&lt;33</td>
</tr>
<tr>
<td>Urethra</td>
<td>D0.03cc[Gy]</td>
<td>&lt;=38.78</td>
<td>43.5</td>
</tr>
</tbody>
</table>

For patients where the maximum point dose to a point that is 0.03 cc exceeds 38.78 Gy, visualization of the urethra is required.
<table>
<thead>
<tr>
<th>VOI List</th>
<th>Volume (cm³)</th>
<th>Min (cGy)</th>
<th>Mean (cGy)</th>
<th>Max (cGy)</th>
<th>CI</th>
<th>nCl</th>
<th>HI</th>
<th>Coverage %</th>
<th>Beam Inter.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTV_3625</td>
<td>50.26</td>
<td>3474</td>
<td>3933</td>
<td>4280</td>
<td>1.85</td>
<td>1.85</td>
<td>1.18</td>
<td>99.88</td>
<td>n/a</td>
</tr>
<tr>
<td>PTV</td>
<td>89.50</td>
<td>2648</td>
<td>3865</td>
<td>4280</td>
<td>1.09</td>
<td>1.15</td>
<td>1.18</td>
<td>94.93</td>
<td>n/a</td>
</tr>
<tr>
<td>Bladder</td>
<td>55.20</td>
<td>517</td>
<td>1637</td>
<td>3877</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Allowed</td>
</tr>
<tr>
<td>Rectum</td>
<td>57.99</td>
<td>251</td>
<td>1135</td>
<td>3598</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Allowed</td>
</tr>
<tr>
<td>Urethra</td>
<td>3.28</td>
<td>3352</td>
<td>3721</td>
<td>3829</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Allowed</td>
</tr>
<tr>
<td>Left Femoral Head</td>
<td>69.47</td>
<td>409</td>
<td>980</td>
<td>1491</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Allowed</td>
</tr>
<tr>
<td>Right Femoral Head</td>
<td>71.39</td>
<td>200</td>
<td>796</td>
<td>1651</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Allowed</td>
</tr>
<tr>
<td>Penile_Bulb</td>
<td>9.19</td>
<td>378</td>
<td>1338</td>
<td>3225</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Allowed</td>
</tr>
<tr>
<td>Skin-15</td>
<td>351.96</td>
<td>51</td>
<td>193</td>
<td>1337</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Allowed</td>
</tr>
<tr>
<td>Testicle block</td>
<td>133.55</td>
<td>58</td>
<td>68</td>
<td>76</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Exit Only</td>
</tr>
<tr>
<td>Sigmoid</td>
<td>80.43</td>
<td>75</td>
<td>253</td>
<td>1072</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Allowed</td>
</tr>
<tr>
<td>Fiducials</td>
<td>0.74</td>
<td>3554</td>
<td>3922</td>
<td>4125</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Allowed</td>
</tr>
<tr>
<td>SpaceOAR</td>
<td>13.35</td>
<td>2083</td>
<td>3507</td>
<td>4059</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Allowed</td>
</tr>
<tr>
<td>ISO 1813 cGy</td>
<td>353.60</td>
<td>1813</td>
<td>2909</td>
<td>4280</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Allowed</td>
</tr>
<tr>
<td>[PTV] Shell 3</td>
<td>54.47</td>
<td>127</td>
<td>757</td>
<td>1423</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>Allowed</td>
</tr>
<tr>
<td>[PTV] Shell 2</td>
<td>31.42</td>
<td>382</td>
<td>1411</td>
<td>2083</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>Allowed</td>
</tr>
<tr>
<td>[PTV] Shell 1</td>
<td>14.08</td>
<td>1739</td>
<td>3179</td>
<td>3760</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>Allowed</td>
</tr>
<tr>
<td>All Target Regions</td>
<td>n/a</td>
<td>2648</td>
<td>3865</td>
<td>4280</td>
<td>1.09</td>
<td>1.15</td>
<td>1.18</td>
<td>94.93</td>
<td>n/a</td>
</tr>
<tr>
<td>All Critical Regions</td>
<td>n/a</td>
<td>51</td>
<td>1169</td>
<td>4280</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>n/a</td>
</tr>
<tr>
<td>Soft Tissue</td>
<td>n/a</td>
<td>32</td>
<td>120</td>
<td>4280</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Post-treatment Considerations

• Chronic GU, GI and sexual toxicity: counsel the patients and know the timeline of side effects with SBRT
• Routine follow-ups with PSA assessment: per NCCN guidelines
• PSA bounce after SBRT (Jiang et al IJROBP 2019)
  – Occurs in a quarter of patients
  – Median magnitude of PSA bounce: 0.52 ng/mL (IQR: 0.3-1.0) after completion of prostate SBRT
  – Median time to bounce: 18 months (IQR 12 – 31)
Conclusion

• SBRT is an excellent treatment modality for localized prostate cancer endorsed by ASTRO, ASCO, AUA, NCCN and COVID19 pandemic guidelines
• Relatively short follow-up time in prospective studies and few high-risk patients included in the trials are limitations of this technique
• While oncologic outcomes appear to be comparable with other EBRT techniques, side effects occur earlier but resolve sooner
• Careful patient selection is needed
• Technological advances: image-guided radiotherapy, SpaceOAR, fiducial markers, MRI-based radiotherapy and robotic SBRT
• Enrollment in ongoing randomized trials such as NRG GU005 and HEAT is strongly encouraged
References


References


Please provide feedback regarding this case or other ARROcases to arrocase@gmail.com